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Strategies for Overcoming Math Anxiety in Developmental Math Students at Community Colleges

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Abstract

Math anxiety is a significant problem among both traditional and adult students attending community colleges. The purpose of this study is to examine effective strategies for overcoming math anxiety in community colleges. The research question for this study was: What tools are community colleges using to help developmental math students overcome math anxiety? A qualitative systematic review of literature was used to answer the research question. The research determined various factors contributed to the development of math anxiety, which is a condition capable of persisting throughout an individual's life. Various instruments such as the Mathematical Anxiety Ratings Scale (MARS), the Short Mathematical Anxiety Rating Scale (SMARS) and the Abbreviated Math Anxiety Scale (AMAS) are useful to assist community colleges with identifying students with higher math anxiety. The research identified expressive writing, development of remedial curriculum, creation of a safe learning environment, use of brief relaxation, use of technology, and group learning techniques as tools to address math anxiety among students in developmental math courses in community colleges. The research supported the conclusion that no one tool is effective for reducing math anxiety among all students in developmental courses in community colleges.

Keywords

Community College; Computer-Assisted Learning; Expressive Writing; Group Learning; Math Anxiety; Relaxation; Technology.

Strategies for Overcoming Math Anxiety in Developmental Math Students at Community Colleges

Math anxiety is a significant problem among both traditional and adult students attending community colleges. Approximately 80% of community college students have math anxiety (Park, Ramirez, & Beilock, 2014). The sense of anxiety associated with math interferes with their ability to master the basic concepts in math courses necessary to obtain a degree (Woodard, 2004). The purpose of this research is to examine effective strategies for overcoming math anxiety in community colleges. The following literature review will explore the nature of math anxiety among community college students and the strategies shown to be useful for overcoming math anxiety among students in developmental math courses.

Math Anxiety

Math anxiety is a feeling of apprehension or tension interfering with manipulating numbers and solving mathematical problems both in ordinary life and academic environments (Jameson & Fusco, 2014). Sources of math anxiety include external factors such as myths and past experiences with teachers and parents, intellectual factors such as learning styles, and personality factors such as low self-esteem and shyness (Woodard, 2004). Among adult learners, a positive

correlation exists between the number of years since the last math class and the level of math anxiety (Jameson & Fusco, 2014; Woodard, 2004).

The general model of math anxiety is based on the assumption that anxiety about math performance creates intrusive thoughts temporarily impairing the functioning of working memory (Park, Ramirez, & Beilock, 2014). The working memory is an element of cognition that holds the intermediate steps in mind necessary to solve complex problems (Benken, Ramirez, Li, & Wetendorf, 2015). Individuals with high math anxiety levels tend to perform poorly when the task is complex such as addition of a column requiring a carryover.

Strategies for Overcoming Math Anxiety in Community Colleges

Some of the research assessing strategies for overcoming math anxiety in developmental courses in community colleges focused on the need for the course to be enjoyable while increasing the self-efficacy of the students (Benken et al., 2015). The type of work performed in the class should reflect the knowledge and skills of the students. An implicit objective of the developmental course should be to build confidence among students in their ability to undertake college-level mathematics. In addition, the most successful instructors use multiple teaching methods to address the needs of learners with differing learning styles (Bonham & Boylan, 2011). Some of the

instructional approaches include increased use of technology, combining classroom and practical lab instruction in math, and project-based instruction. The objective is to use methods with which the student feels comfortable and does not have pre-existing math anxiety associations. The teaching methods should also incorporate different learning modalities such as visual, aural, and kinesthetic teaching methods (Panitz, 2010).

According to Verkijika, and De Wet (2015), computer-based games that involved a non-invasive brain computer interface could be useful for implementing cognitive behavioral approaches to reduce math anxiety. The interface provided feedback about the level of anxiety the student felt and adjusted the math tasks accordingly to reduce anxiety. The technology, however, may be too costly for widespread use in developmental math classrooms at the current time.

Research examining the cognitive processes associated with math problem solving found that presenting the students with cues as to whether a math problem will be a math sets or word problems proved useful for reducing math anxiety (Beilock & Maloney, 2015). The cue activated regions in the brain that assisted in problem solving and reduced the amount of intrusive thoughts interfering with working memory. The approach also theoretically transformed the student's perception of the upcoming math task from a threat to a challenge. A relaxation

cue may also be helpful for reducing math anxiety. Bruneye et al. (2013) conducted a randomized controlled trial of three different approaches to control math anxiety among college students in developmental math classes. The findings showed that a deep and focused breathing exercise undertaken immediately before attempting to solve a math problem was effective for improving math performance. The findings suggested that developmental math classes should include instruction on approaches to control anxiety as well as supervised practice.

The literature indicated that the method of assessing students in developmental courses is important for overcoming math anxiety. Research by Woodard (2004) identified methods such as grading the procedure rather than the answer as important for reducing math anxiety. In addition the use of computers to perform routine tasks, such as addition, allowed the student to focus on the underlying mathematical processes. The assessment process should also emphasize positive abilities found as a result of the assessment rather than the negative aspects associated with the failure to learn specific material (Bonham & Boylan, 2011).

Another approach sometimes useful for overcoming math anxiety was to have students write about their feelings and emotions in math classes (Beilock & Willingham, 2014). The exercise helped to clarify the causes of anxiety and may reduce

its affect on students. Park, Ramirez, and Beilock (2014) conducted a randomized controlled trial of community college students with the experimental group writing about their math anxiety. The findings indicated that the experimental group had higher math performance levels than the control group not using the writing strategy. The research relied on the Short Math Anxiety Rating Scale (SMARS) to identify students with higher math anxiety levels to participate in the study (Park, Ramirez, and Beilock, 2014).

Another practice identified in the literature to address math anxiety was to allow the students to work in small groups (Cafarella, 2014). Working in small groups is functionally a cooperative learning strategy in which the students work together to achieve a learning goal (Daneshamooz, Alamolhodei, & Darvishian, 2012). The approach assists the students helping them feel more relaxed. In addition, the students with better math abilities can assist the students with addressing math anxiety by explaining some of the approaches they use for problem solving. The approach is intended to create a safe learning environment for the students in which they can express themselves without fear of ridicule (Bonham & Boylan, 2011). Promoting a safe learning environment may require enforcing classroom etiquette and emphasizing the responsibility of all students in groups to help each other.

Panitz (2010) conducted research and found working in small groups is an effective cooperative learning strategy for overcoming math anxiety because it addressed some of the contributing factors. The small group eliminated the imposing authority of the instructor and led to longer time frames for problem solving. The cooperative learning approach encouraged students to become active learners by emphasizing the responsibility to support the group. Daneshamooz, Alamolhodei, and Darvishian (2012) conducted a randomized controlled trial and determined that cooperative learning was more effective for overcoming math anxiety and improving academic performance than traditional classroom instruction or computer-assisted instruction. Daneshamooz, Alamolhodei, and Darvishian (2012) used the full-length Mathematics Anxiety Rating Scale to assess the effectiveness of each of the three instructional approaches.

Tools To Overcome Math Anxiety

The research question addressed in this study was: What tools are community colleges using to help developmental math students overcome math anxiety? A qualitative methodology involving narrative synthesis of previous quantitative and qualitative studies was used to answer the research question and to explore the nature of math anxiety among developmental mathematics students in community colleges. The criteria used for identification of information from previous studies were: 1)

publication in peer-reviewed journals; 2) relevance to identification of tools to overcome math anxiety; and 3) relevance to developmental math at the community college level.

Nature of Math Anxiety

The origin of math anxiety varies with environmental, intellectual, and personality factors influencing attitudes towards math (Woodard, 2004). Negative experiences with parents, teachers, and peers can foster anxiety when faced with a math task. Math anxiety was also associated with factors such as dyslexia or preferences for kinesthetic or aural learning styles. Some individuals also showed a cognitive predisposition to math anxiety (Beilock & Maloney, 2015). Students who were shy or have low self-esteem may also felt intimidated by math tasks.

For most students, math anxiety develops in elementary school and persists throughout an academic career (Woodard, 2004). Consequently, students in developmental math courses in community colleges often suffer from persistent math anxiety. Adults with math anxiety often have shortcomings in some of the fundamental skills associated with math, such as counting or determining which of two numbers represents a larger quantity (Beilock & Willingham, 2014). When the skills deficit develops early in the educational process, a student is far more likely to experience anxiety when faced with a math task. In addition, non-traditional students in community colleges who tend to be

older than traditional students have higher levels of math anxiety (Daneshamooz, Alamolhodei, & Darvishian, 2012). The math anxiety leads to poor performance in developmental math classes and the reluctance of students to select courses and majors requiring math proficiency (Beilock & Maloney, 2015). By the time students reach community college, the anxiety is deep-seated and difficult to address.

Individuals with high math anxiety experience negative intrusive thoughts when they attempt to perform a math task. The intrusive thoughts are most apparent in math problems that involved working memory (Park, Ramirez, & Beilock, 2014). The intrusive thoughts create a situation in which an individual is simultaneously attempting to concentrate on a math problem and the negative past experiences represented by the intrusive thoughts. The intrusive thoughts also reduce the motivation of students and the persistence necessary to grasp math concepts the students perceive as difficult. When the student experiences anxiety about math, the intrusive thoughts occupy working memory, which has limited capacity (Beilock & Maloney, 2015).

The existence of math anxiety as a neurological phenomenon has been established by MRI testing of individuals with high math anxiety (Beilock & Maloney, 2015). When faced with a task involving math operations, the centers of the brain associated with negative emotions are more active among individuals with

high math anxiety. In addition, the MRIs of individuals with high math anxiety showed less activity in the areas of the brain associated with working memory.

Student Assessment

Some community colleges assess students for math anxiety as part of the initial placement process. The assessment is important for determining whether a student should be assigned to a developmental math course in community college specifically addressing math anxiety issues. The math anxiety assessment also provides an indication of the students' perceived math self-efficacy and attitudes towards math studies.

Student assessments, as well as research examining math anxiety, rely on the Mathematical Anxiety Rating Scale (MARS) or the Short Math Anxiety Rating Scale (SMARS) (Park, Ramirez, & Beilock, 2014; Woodard, 2004). The MARS scale was originally developed by Suinn, Edie, Nicoletti, and & Spinelli, (1972) and has been subsequently validated and shortened to form the SMARS. The MARS and SMARS scales present various life scenarios such as being treasurer of a club or signing up for a math class. Individuals participating in the assessment express their level of anxiety associated with the scenario on a 5-point scale.

The original MARS scale consisted of 96 item measuring math anxiety across the dimensions of text anxiety and numerical anxiety. The main criticism of the MARS scale was the large

number of items, which are time consuming for students to complete. Consequently, researchers shortened the instrument to form the SMARS scale. The SMARS scale contains statements asking students how they feel about various situations involving mathematics such as a task involving word problems. Various forms of the SMARS scale have been used to assess student math anxiety. The SMARS scale used by Park, Ramirez and Beilock (2014) used 25 items with ratings ranging from 0 to 4 with 4 indicating a high level of anxiety experienced in the situation. A student scoring above 40 for the items in the scale was considered to have a high degree of math anxiety. The scale used by Daneshamooz, Alamolhodei, and Darvishian (2012) used 32 items with ratings ranging from 5 for higher anxiety to 1 for low anxiety. With this version of the instrument, students scoring above the class mean were considered to have high math anxiety.

The Abbreviated Math Anxiety Scale (AMAS) is also an instrument available to assess math anxiety among students (Jameson & Fusco, 2014). The scale has only nine items and therefore can be completed in a very short period of time. The AMAS is similar to other math anxiety scales, asking students to rate their feelings of anxiety in various hypothetical situations with a rating of 1 indicating low anxiety and a rating of 5 indicating high anxiety. The scale has been

validated and is an accurate measure of math anxiety among students.

Expressive Writing

Expressive writing is a strategy used in some community colleges to reduce math anxiety (Beilock & Maloney, 2015; Park, Ramirez, & Beilock, 2014). Expressive writing is a technique used in clinical psychology to assist individuals to overcome various types of anxiety issues, which can be easily adapted for use in community college classes. The individual writes thoughts and feelings about a specific stressor creating anxiety in their lives. In the case of math anxiety, the writing takes place approximately 15 minutes prior to undertaking the math task and should be undertaken on several occasions to provide a long-term benefit of reducing anxiety when confronting the stressor of the need to perform a math task. The amount of time spent in writing should be between five and ten minutes. Expressive writing is also helpful for increasing the capabilities of working memory, which is an important factor for controlling the negative effects of math anxiety.

Research determined even a single session of expressive writing was sufficient to produce a temporary improvement in math scores among individuals with high levels of math anxiety (Park, Ramirez, & Beilock, 2014). Maximum benefit from expressive writing comes from repeatedly engaging in writing

exercises prior to encountering the situation involving math processes creating the anxiety. The word count in each expressive writing session need not be extensive with as little as 300 words effective for reducing math anxiety. Beilock and Willingham (2014) indicated the proximity of the writing to a test or other task involving math was an important factor for reducing math anxiety. Consequently, math instructors in community colleges who incorporate expressive writing into the curriculum can assist some students with reducing math anxiety by having a brief writing exercise immediately before tests or problem solving activities.

Before undertaking the expressive writing, the instructor should discuss the concept of anxiety associated with math and the purpose of the writing (Beilock & Willingham, 2014). The instructor should also present the writing as a reflective exercise in which students explore the source of their anxiety and possible approaches to controlling the anxiety. For the writing to be effective for reducing math anxiety, students have to be as open as possible. The instructor should also assure the students that the content of the writing is private and will not be viewed by the instructor or other students.

While the mechanism by which the expressive writing reduces math anxiety is unclear, Park, Ramirez, and Beilock (2014) argued the possibility of anxious thoughts capturing attention

when performing a math task. The research showed that writing about the math anxiety prior to performing the task frees the working memory space, allowing the student to concentrate on math rather than anxiety. It is also possible that the expressive writing task distances the student from the feelings of anxiety at least temporarily, allowing the student to focus on performing the math task in a testing situation. Another possibility is the expressive writing helps transform the perception of the math task from a threat to a challenge (Beilock & Maloney, 2015).

A variation on expressive writing investigated by Bruneye et al. (2013) involved asking students to write the answers to specific questions about anxiety asked in reasonably close proximity to the time of performing the math activity. The questions were intended to produce anxiety and involve possible events such as being the victim of discrimination or a terrorist act. The student was then to write a response to the situation, which functions to lessen feelings of anxiety. The approach was successful for improving scores among students in community colleges and universities with high math anxiety.

Remedial Curriculum

Ensuring the curriculum in developmental courses in community colleges is designed to remediate fundamental shortcomings in math is also an important tool for addressing

math anxiety. Beilock & Willingham, (2014) found an association existed between the lack of fundamental skills and math anxiety. Since developmental courses are designed to offer students mathematics instruction below the college level, they are intended to prepare the student for college work (Carafella, 2014). The curriculum for a development course should include very basic math skills, including targeted exercises to improve confidence in math abilities.

Carafella, (2014) found an important tool in developing a remedial curriculum was the concept of compression of the course material. The traditional linear approach used in college-level math developmental courses may leave some students bored and may result in knowledge gaps when students miss classes. In contrast, a compressed curriculum can allow students to focus on specific areas of weakness, which can include fundamental skills such as addition, division, or fractions as well as more advanced topics such as algebra. The institution can also create developmental math courses for different student levels of ability, with the compressed curriculum appropriate for the abilities of the student.

Ideally, the objective of remedial curriculum is not only to instruct students in basic math concepts and processes but also to improve their attitude towards the study of math. Math anxiety is often rooted in the past experiences of failure

(Benken et al. 2015). Consequently, the curriculum should focus on assisting the student with achieving small successes in math to foster a belief in self-efficacy and a positive attitude towards math. A positive attitude based on successes may reduce the student's concerns about math and the intrusive thoughts impairing performance when solving math problems.

Safe Learning Environment

Creating a learning environment students perceive as safe was another tool for helping students overcome math anxiety (Bonham & Boylan, 2011). Students should feel comfortable asking for assistance and making mistakes. The objective of the safe learning environment was to avoid many of the negative reactions of teachers and peers to poor math skills the students may have experienced in the past. Some of the specific techniques associated with creating a safe learning environment included emphasizing the importance of mutual support, use of group activities to build relationships with peers, and written affective assessments to help students understand their attitudes towards math. In addition, the instruction can include information about relaxation techniques to reduce anxiety when confronted by math anxiety.

Constructing a safe learning environment was particularly important for older adults who are considered non-traditional learners attending community college (Jameson & Fusco, 2014).

This research showed that providing a safe learning environment was based on the assumption that the level of self-efficacy and the individual's self-concept with respect to math affected attitudes and willingness to perform math-related tasks. Jameson & Fusco, (2014) found that an approach in which the instructor assisted the student with developing self-confidence could counteract some of the student's negative beliefs about the ability to solve math problems.

The approach taken in some community colleges involved the instructors acting as coaches to assist students with developing confidence in their ability to understand math processes (Panitz, 2010). Rather than attempting to teach new concepts to students, the instructors assisted the students with revisiting fundamental concepts with the student guiding the learning process. The objective of the coaching was for the student to develop an increased sense of self-efficacy for math operations and processes.

Brief Relaxation

Brief relaxation interventions have been found to be effective for temporarily reducing math anxiety and for improving scores on math tests in some community colleges (Bruneye et al., 2013). The brief relaxation takes place immediately before performing a math activity such as a test. With sufficient classroom guidance and practice, students adopt

brief relaxation as a tool to reduce math anxiety whenever faced with the need to perform tasks involving math. An advantage of brief relaxation tools was the ability to incorporate the tool into the routine classroom activities in developmental math courses in community colleges.

The approach to brief relaxation most effective for reducing the effects of math anxiety was focused breathing using guided mindfulness (Bruneye et al., 2013). According to this approach, the students paid careful attention to the process of inhaling and exhaling, which cleared intrusive thoughts from the mind. The instructor tells the students repeatedly to focus on the breathing process if thoughts wander. The focused breathing resulted in higher scores in tests involving timed mental addition among students with high math anxiety. Focused breathing was also associated with a general calming effect to reduce feelings of panic and anxiety (Beilock & Mahoney, 2015). Other brief relaxation techniques such as unfocused relaxation in which the mind wanders were not as effective as focused breathing for reducing math anxiety among students.

Technology

Technology was another tool that could be effective for overcoming math anxiety in developmental math courses in community colleges. Some community colleges relied on commercial software, allowing the students in developmental math courses to

proceed at their own pace when learning math concepts and processes (Bonham & Boylan, 2011). The software could also deliver tutorials explaining basic math concepts and processes linked with practice to reinforce learning. Bonham & Boylan (2011) found the approach theoretically helps the student overcome math anxiety by creating a series of small successes in learning to build self-confidence when faced with more complex tasks in a developmental math course.

Some research examining outcomes from the use of technology for developmental instruction in community colleges has determined the approach functions better when the technology is part of a comprehensive program including supplemental instruction and personal instruction (Bonham & Boylan, 2011). In addition, the specific software used to assist with overcoming math anxiety should have a strong focus on fundamental skills, which are often deficient among students with high math anxiety (Cafarella, 2014).

The use of technology and computer-assisted learning may not be beneficial for all community college students with significant levels of math anxiety (Daneshamooz, Alamolhodei, & Darvishian, 2012). The students must have sufficient proficiency with the technology to ensure the operation of the technology does not become a distraction from the math problem or an additional source of anxiety. Students with high working memory

capacity tend to perform better than students with low working memory capacity in self-directed learning supported by technology. Consequently, the use of technology may be beneficial only for students with high working memory capacity who have high math anxiety. In contrast, students with low working memory capacity and high math anxiety may require other non-technological approaches to help them gain skills and confidence with math concepts and processes.

An innovative use of technology that has been used in some colleges outside the United States is the brain computer interface linked to a computer game (Verkijikia & De Wet, 2015). The brain computer interface involves a communication for controlling an electronic device such as a computer through bio-potentials such heart rate. The non-invasive form of the interface consists of a cap worn on the head with electronic sensors to assess the user's movements and physiological responses. The sensors are connected to the electronic device. The interface theoretically speeds the time necessary to give commands to the electronic device. The game involves some type of math process embedded into the rules of play such as adding a column of numbers to advance the player towards a goal. The assumption underlying the use of games for reducing math anxiety is the focus of the student is on play, which gradually reduces the intrusive thoughts producing the anxiety. The game playing

also reinforces basic math skills through repetition. Using a brain computer interface accelerates the process of anxiety reduction and learning. The interface reduces the amount of cognitive awareness the student has concerning the mechanics of game play, which allows working memory to focus primarily on the math tasks necessary for play. The use of brain computer interfaces linked to math games has been effective for reducing math anxiety among college students. The approach, however, is not widespread in community colleges because of the costs associated with the technology.

Group Learning

Some community colleges emphasize the importance of group or collaborative learning approaches to address math anxiety and improve learning outcomes in developmental math courses (Cafarella, 2014). The general approach used for group learning involves assigning students to work groups with the group collaboratively solving a math problem. The students feel less anxiety when working with peers because they realize they are not alone in their struggle to overcome negative thoughts associated with math. In addition, the student experiences less pressure to demonstrate knowledge of math techniques because of the ability to collaborate with peers when uncertain of the approach to solve a math problem. In addition, students feel less anxiety when attempting to explain how to solve a math

problem to another individual. Also, students are more likely to ask peers for help than teachers if they have had negative experiences with math teachers in the past.

The collaborative group to solve math problems theoretically functions as a team learning community eliminating the perspective of students in competition with all other students (Daneshamooz, Alamolhodei, & Darvishian, 2012). The students work together to achieve goals each student would find very difficult to achieve if working independently. Successfully achieving the goal builds confidence in ability to perform math processes, which can overcome math anxiety.

The specific techniques used for overcoming math anxiety with group learning vary (Panitz, 2010). Some groups consist of only two students who provide support for each other when working through assigned math problems. Some groups consist of many students with the group determining who should address specific assigned problems. The instructor is available to provide assistance to the group members if they encounter difficulties with solving the assigned problems.

The use of group or collaborative learning in some community college developmental math courses allows the group to select different means of addressing problems. For example, the group can make use of technology, visual aids, or any other approach the learners consider necessary to grasp the basic math

concepts or processes (Panitz, 2010). Randomly assigning students to groups is also beneficial for ensuring the group members represent diverse perspectives and styles of learning, which could be helpful to enhance the learning process of all members of the group.

The math support community is a variant of the group learning tool to overcome math anxiety used in some community colleges (Bonham & Boylan, 2011). The community operates online and provides a forum in which students can express concerns and receive information about math from others. The community includes students in a specific math development class as well students in other classes and instructors. The community provides practical and emotional support for members struggling with math anxiety problems. Math support communities are associated with higher performance outcomes for students with math anxiety. Participation in the support community, however, is often voluntary, which raises the possibility of reluctance to participate among some students with high math anxiety.

Conclusion

Math anxiety affects many students in developmental courses in community college. The anxiety is likely to have originated early in the educational process and is likely to be a major factor affecting the attitude towards mathematics among many community college students. The various studies examining math

anxiety indicated the anxiety can be overcome through the use of various tools intended to reduce the feeling of anxiety whenever the student is face with math.

Several instruments are available to assist community colleges with identifying students with math anxiety issues, such as the AMAS, the MARS, and the SMARS. The ability to identify students with high math anxiety can lead to the development of courses focusing on remediating math anxiety rather than attempting to develop specific math skills necessary to perform college level work. Community colleges could also consider the math anxiety management course as a prerequisite for the standard remedial courses teaching students the basic math skills necessary to achieve in college-level math courses. The math anxiety development course would be based on the assumption that students with high math anxiety must initially address the anxiety before advancing in math studies.

A variety of tools are available to addressing high math anxiety among students in developmental math courses in community colleges. Some of the tools include expressive writing, redesigning the math remedial curriculum, creating a safe learning environment, brief relaxation, the use of computer technology, and group learning approaches. A conclusion based on the analysis of various methods to address the problem of math anxiety is that no single tool is appropriate for all students.

Research indicates that the various tools for addressing math anxiety in community colleges are effective for some students (Beilock & Maloney, 2015; Bonham & Boylan, 2011; Cafarella, 2014; Daneshamooz, Alamolhodei, & Darvishian, 2012; Park, Ramirez, & Beilock, 2014). Because of the differences in learning styles of students and the factors contributing to math anxiety, math development courses in community colleges should use several tools to assist students with math anxiety.

The resources the community college has available to commit to math development courses can be a barrier to the use of some math anxiety tools. Some of the tools, however, do not require extensive resources. Instructors of developmental math courses an incorporate expressive writing, brief relaxation techniques, and group learning approaches with no additional resources required for the course. In contrast, technology tools for addressing math anxiety have a higher cost for students and institutions.

Further research should be conducted to determine the most effective tools to address math anxiety among community college students in math development courses. Prior research has examined the effectiveness of different tools and strategies to reduce high math anxiety in isolation from each other. Comparative research evaluating the outcomes of using different tools to reduce math anxiety would provide helpful guidance for

instructors and administrators at community colleges when considering the content of math development courses.

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